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Alaska surf clam survey in limited areas within the southern Bering Sea, 1993.

By

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

The Alaska surf clam *Spisula polynyma*, sometimes referred to as the pinkneck clam, is found in intertidal and subtidal waters of Alaska. This large clam reaches a shell length of 146 mm in the Bering Sea (Hughes and Bourne 1978). Sexual maturity for Alaska surf clams in the Bering Sea, has been estimated at a shell length of approximately 70 mm, and an age of between 7 and 8 years (Feder 1979 et. al). The Atlantic surf clam *Spisula solidissima* has similar life history parameters and has been harvested for many years in waters from Nova Scotia, Canada to South Carolina, United States (Cerrato and Keith 1992). There has been no commercial harvest of surf clams in the Bering Sea, however it was desired to investigate the abundance and harvestability of Alaska surf clams.

Mr. Kopplin of the Alaskan Clam Corporation thought there might be a harvestable stock of Alaska surf clams in the southern Bering Sea based on past surveys (Hughes and Nelson 1979, Hughes et al. 1977). In August 1993, William Kopplin applied to the Alaska Department of Fish and Game (ADF&G) Commissioners Office for an Oceanic Research Services Permit to survey specific areas in the Bering Sea for surf clams stocks. The permit contained several provisions, including an onboard observer requirement.

The observer was charged with collecting biological samples from the catch. Duties were detailed in a pre-trip briefing by ADF&G staff in Dutch Harbor. Upon completion of the survey, the data was supplied to ADF&G, Commercial Fisheries Management and Development Division (CFMDD) biometric staff for analysis. Abundance and density estimates of Alaska surf clams, length distribution of Alaska surf clams, and bycatch composition from the dredge operations were examined. Bycatch species of most concern were commercially important crabs which inhabit the survey areas, specifically Tanner (genus *Chionoecetes*), king (genus *Paralithodes*) and Korean hair (*Erimacrus isenbeckii*) crabs. This report summarizes the findings of the survey.

METHODS

Field Collection

Two 18.5 by 18.5 km areas (blocks) were designated as the study sites (Figure 1). The two blocks were enumerated blocks 57 and 50, as designated by the 1977 and 1978 NMFS surveys (Hughes and Nelson 1979, Hughes et al. 1977). A thousand locations, in longitude/latitude, within each block were randomly selected to be used as tow locations. Those locations were provided to Mr. Kopplin by the ADF&G staff. Mr. Kopplin surveyed the blocks using as many stations, in the order given, as time allowed.

Towed by the 22.86 m F/V *Northern Explorer*, a 1.22 m wide surface supplied hydraulic clam dredge was used to collect the surf clams at each towed location. Survey plans called for the dredge to be towed for approximately 15 minutes, at a speed of about 3.7 kilometers per hour (kph). The dredge was then brought onboard and the contents emptied on deck. If there were any problems with dredging at a specific location, it was noted on the Captain's Log and dredging was terminated.

The dredge contents were separated by species. Each species group was weighed and the weight was recorded by the observer. From the Alaska surf clams caught, a subsample of up to 35 clams per tow were taken for shell length measurements. If there were fewer than 35 clams caught, then all clams were measured. Also, the weight of broken, or crushed surf clam shells were weighed and the weight recorded. In addition to living organisms, the weight of rocks collected was recorded.

A subsample of Alaska surf clams collected during the survey were sent to the Alaska Department of Environmental Conservation (DEC). Clams were tested to determine levels of paralytic shellfish poison (PSP). Shellfish designated safe for human consumption is required by DEC to have levels of PSP below 70 mg/100 gm (personnel communications Al Spalinger, Shellfish biologist, ADF&G, Kodiak, Alaska).

Data Analysis

Density and abundance of Alaska surf clams were the two main parameters of concern. The density was estimated in terms of catch per unit effort (CPUE), measured as the weight in kilograms of intact Alaska surf clams caught in a specific tow divided by the area in hectares covered during that tow. The area covered by the tow was estimated by the width of the clam dredge (1.22 m) multiplied by the average speed of the ship during the tow in km per minute multiplied by the time of the tow in minutes and multiplied by 0.1 to convert to ha. To measure central tendency for density of Alaska surf clams within each block, the sample median and mean densities were estimated, along with the standard error for the mean. The two average density values from block 57 and 50 were compared using a Mann-Whitney test of means (Conover 1988), to determine whether the two densities were significantly different. Total abundance of surf clams in each block was estimated by multiplying the mean density in each block by the surveyed area. The surveyed area was defined as the portion of the block where successful tows were completed. The standard error of the abundance was estimated by multiplying the density standard error, also by the surveyed area. The density and abundance estimations were calculated including broken or crushed surf clams as well as whole surf clams, since there was no distinction on the observer form or captains log on severity or age of the breaks, i.e. there was no indication of whether the breaks were due to dredging or empty shells caught in the dredge.

The loss rate was estimated for each block. The loss rate (measured in percent) was calculated by dividing the amount in kilograms of broken or crushed surf clams by the total (intact and broken) weight of surf clams for each block.

Average surf clam shell length was calculated for each block. All shell lengths were pooled for each block to find the average length, due to few shell measurements in several tows,. The average shell lengths for the two blocks were compared by using a standard t-test (Zar 1982), to evaluate whether one block had significantly different lengths than the other block.

Mean density estimates by block were calculated for incidental species captured in more than two tows per block. Also, an association between Alaska surf clams and other species was investigated by estimating the Pearson's correlation coefficient (Zar 1982) between surf clam (intact and broken) density (CPUE) and other species densities (CPUE) by tow location and within blocks. The

correlation between surf clams and other species was estimated to quantify species most likely affected by an initiation of an Alaska surf clam fishery. Correlations were estimated only between those species caught in more than 4 tows per block.

RESULTS

The two blocks surveyed represent less than 0.01% of the Bering Sea and likely only a small portion of Alaska surf clam habitat. In each of the two blocks only a fraction of the areas were surveyed because of depth and substrata limitations for this gear and boat. Out of the first 100 randomly selected tow locations in block 57, only 20 were deemed useable, with 78 tow locations being too deep and 2 locations classified as too rocky (Figure 2, Appendix A). This implies only 20% (20/100) of block 57 was surveyed, or an area of approximately 6,845 ha. Out of the first 30 randomly selected tow locations in block 50, once again 20 were deemed useable, with 5 locations considered too deep, 3 locations considered too rocky and 2 locations located on land or shallow water (Figure 3, Appendix A). For block 50, 66.7% (20/30) of the block was surveyed, an area of approximately 22,817 ha. Of the 20 locations where tows were performed in block 50, 6 were not sampled due to too many rocks in the gear to bring it on-board. It was noted of these 6 tows, that no surf clams were seen in the dredge. Furthermore, in each block an extra tow (not from the list of random locations) was performed by Mr. Kopplin because he wanted to compare surf clam catches from this survey to the 1978 survey catches within these blocks (Appendix A). These tows were not used in any of the analyses in this document.

Samples were taken for PSP detection from four stations in block 57, and from three stations in block 50. All samples taken for PSP detection resulted in levels safe for human consumption (Table 1).

The mean density of intact Alaska surf clams in block 57 was 64.24 kg/ha, with a standard error of 15.80 kg/ha. The median density of intact Alaska surf clams was 39.95 kg/ha. Due to the positively skewed nature (Figure 4) of the density of Alaska surf clams caught in block 57, the median is the better measure of central tendency. The mean density of all surf clams (broken and intact) landed in block 57 was 86.34 kg/ha, with a standard error of 18.14 kg/ha. The median density of all caught Alaska surf clams was 62.61 kg/ha. The estimated total biomass of Alaska surf clams within the surveyed area of block 57 was 590,997 kg, with a standard error of 124,145 kg.

The mean density of intact Alaska surf clams in block 50 was only 4.13 kg/ha, with a standard error of 1.34 kg/ha. The median density of intact Alaska surf clams was 0.00 kg/ha. The mean density of all surf clams landed in block 50 was 6.37 kg/ha, with a standard error of 2.34 kg/ha. The median density of all Alaska surf clams was also 0.00 kg/ha. Once again the median is the better measure of central tendency in block 50, due to the skewed nature of the data (Figure 4). The estimated total biomass of Alaska surf clams within the surveyed area of block 50 was 145,370 kg, with a standard error of 53,377 kg.

There was a significantly ($p < 0.001$) higher density surf clams found in block 57 than in block 50. This was true in comparing both the intact surf clams, as well as when considering the all surf clams.

The loss rate in block 57 was estimated at 25.6% , while in block 50 the loss rate was estimated at 35.2%. The number of trawls that caught surf clams in block 57 was 20 out of 20 (100%) whereas in block 50 only 7 out of 20 (35%) tows caught surf clams.

The shell lengths for the two blocks had different histograms (Figure 5). The mean shell length from the 414 samples in block 57 was 100.5 mm, with a standard error of 0.62 mm. In block 50, the mean shell length from the 45 samples was 95.7, and the standard error 1.76 mm. There was, however a significant ($p=0.0052$) difference between the two blocks shell lengths, with block 57 having slightly larger shells. Due to the low numbers of surf clams caught in block 50, no further analysis was attempted to consider other factors which may have affected this outcome, such as depth or temperature.

Several other species were caught during the survey (Tables 2 and 3), however only a few of these organisms have commercial importance in the Bering Sea. Unidentified starfish species were the most common organisms caught during the survey by weight. The average density of starfish in block 57 was 190.3 kg/ha, with an average density in block 50 of 215.9 kg/ha (Tables 2 and 3). Tellins unidentified but likely *Tellina lutea* had the highest density correlation with surf clams with a Pearson correlation in block 57 of 0.77 and 0.77 in block 50. No commercially important crab species were caught. The only type of crabs caught were hermit crabs (unidentified but likely genus *Pagurus*), and a single helmet crab *Telmessus cheiragonu.* Furthermore, the only fish species caught were yellowfin sole *Limanda aspera* and rock sole *Lepidopsetta bilineata.* Both fish species were caught at very low levels, a total of 0.2 kgs each.

The most common item caught by weight was rocks, with total catch of 743.5 kg in block 57 and 1,264.2 kg in block 50. Rocks occurred in 65% of the tows in block 57 and 85% in block 50. Rocks tended to be slightly negatively correlated with Alaska surf clam catches (-0.29 block 57, -0.33 block 50), but this may be a function of rocks filling up the dredge and excluding organisms, rather than surf clams being found in less rocky habitat.

LITERATURE CITED

Cerrato, R.M. and D.L. Keith. 1992. Age structure, growth, and morphometric variations in the Atlantic surf clam, *Spisula solidissima*, from estuarine and inshore waters. Marine Biology 114: 581-593.

Conover, W.J. 1980. Practical Nonparametric Statistics, 2nd edition. John Wiley & Sons, New York, New York. p. 493.

Feder, H.M., A.J. Paul and J.M. Paul. 1978. The pinkneck clam *Spisula polynyma* in the eastern Bering Sea growth, mortality, recruitment and size at maturity. Sea Grant Report No. 78-2, University of Alaska, Sea Grant Program.

Hughes, S.E. and N. Bourne. 1981. Stock assessment and life history of a newly discovered Alaska surf clam (Spisula polynyma) resource in the southeastern Bering Sea. Canadian Journal of Fisheries and Aquatic Sciences 38 (10): 1173-1181.

Hughes, S.E. and R.W. Nelson 1979. Distribution, abundance, quality, and production fishing studies on the surf clam, *Spisula polynyma*, in the southeastern Bering Sea, 1978. NWAFC Processed Report 79-4, 61 p. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

Hughes, S.E., R.W. Nelson, and R. Nelson. 1977. Initial assessments of the distribution, abundance and quality of subtidal clams in the SE Bering Sea. Processed Report 43 p. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

Zar, J.H. 1984. Biostatistical Analysis. Prentice-Hall, Englewood Cliffs, New Jersey.

Table 1. PSP levels reported from the Alaska Department of Environmental Conservation PSP Report, providing location and level of PSP from samples taken during the Alaska surf clam survey, in 1993.

Block	Station	Date[a]	PSP Level (µg)
57	110	12/02/93	33
57	133	12/02/93	33
57	159	12/02/93	33
57	191	12/02/93	33
50	213	12/02/93	33
50	219	12/02/93	33
50	224	12/02/93	33

[a] Date refers to the day the lab recieved the sample from the survey.

Table 2. Catch, density, and percentage of occurrence (number of tows surf clams captured divided by 20 successful tows) of organisms and rocks caught in block 57 during the 1993 Alaska surf clam survey in the southern Bering Sea.

Organism	Total catch (kg)	Average CPUE (kg/ha)	Occurance (%)	Alaska surf clam correlation
Alaska surf clams (intact only)	97.2	64.2	100	0.97
Alaska surf clams (total)	131.1	86.3	100	1.00
Starfish	294.8	190.3	100	0.59
Tellins	8.1	5.2	80	0.77
Razor clams	3.2	2.0	45	0.35
Arctic Mya	1.8	1.2	20	-0.37
Snails	0.6	0.4	15	N/A
Hermit crabs	0.2	0.1	10	N/A
Sand fish	0.7	0.4	10	N/A
Yellowfin sole	0.2	0.1	10	N/A
Rocks	743.5	507.6	65	-0.29

Table 3. Catch, density, and percentage of occurrence (number of tows surf clams captured divided by 20 successful tows) of organisms and rocks caught in block 50 during the 1993 Alaska surf clam survey in the southern Bering Sea.

Organism	Total catch (kg)	Average CPUE (kg/ha)	Occurance (%)	Alaska surf clam correlation
Alaska surf clams (intact only)	7.0	4.1	35	0.90
Alaska surf clams (total)	10.9	6.4	35	1.00
Starfish	246.3	215.9	65	0.47
Tellins	1.0	0.8	30	0.77
Razor clams	0.8	0.1	20	0.24
Sand dollars	147.5	124.4	15	N/A
Rocks	1,264.2	1,130.6	85	-0.33

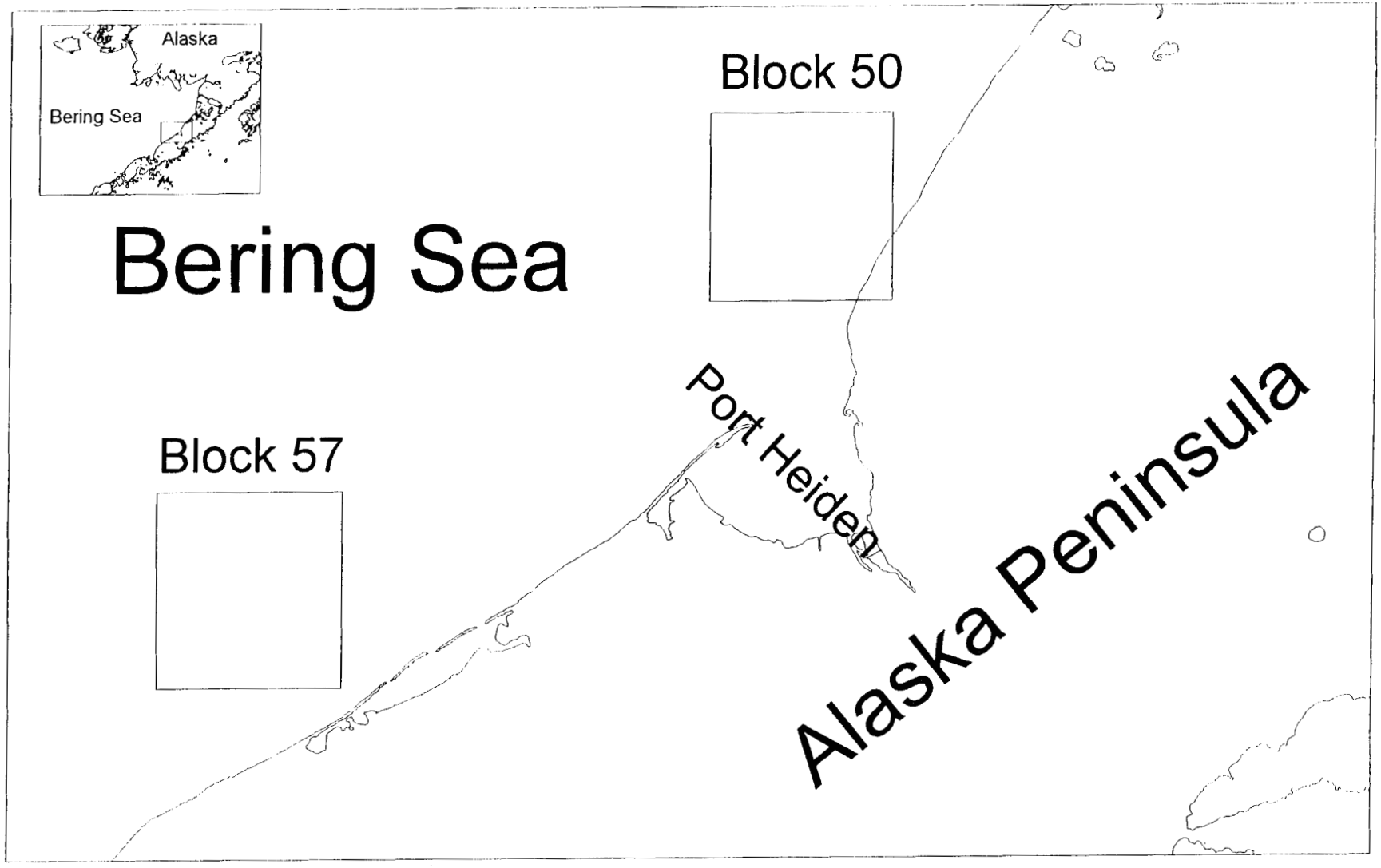


Figure 1. Map of the Bering Sea, showing the location of the two blocks sampled during the Alaska surf clam survey

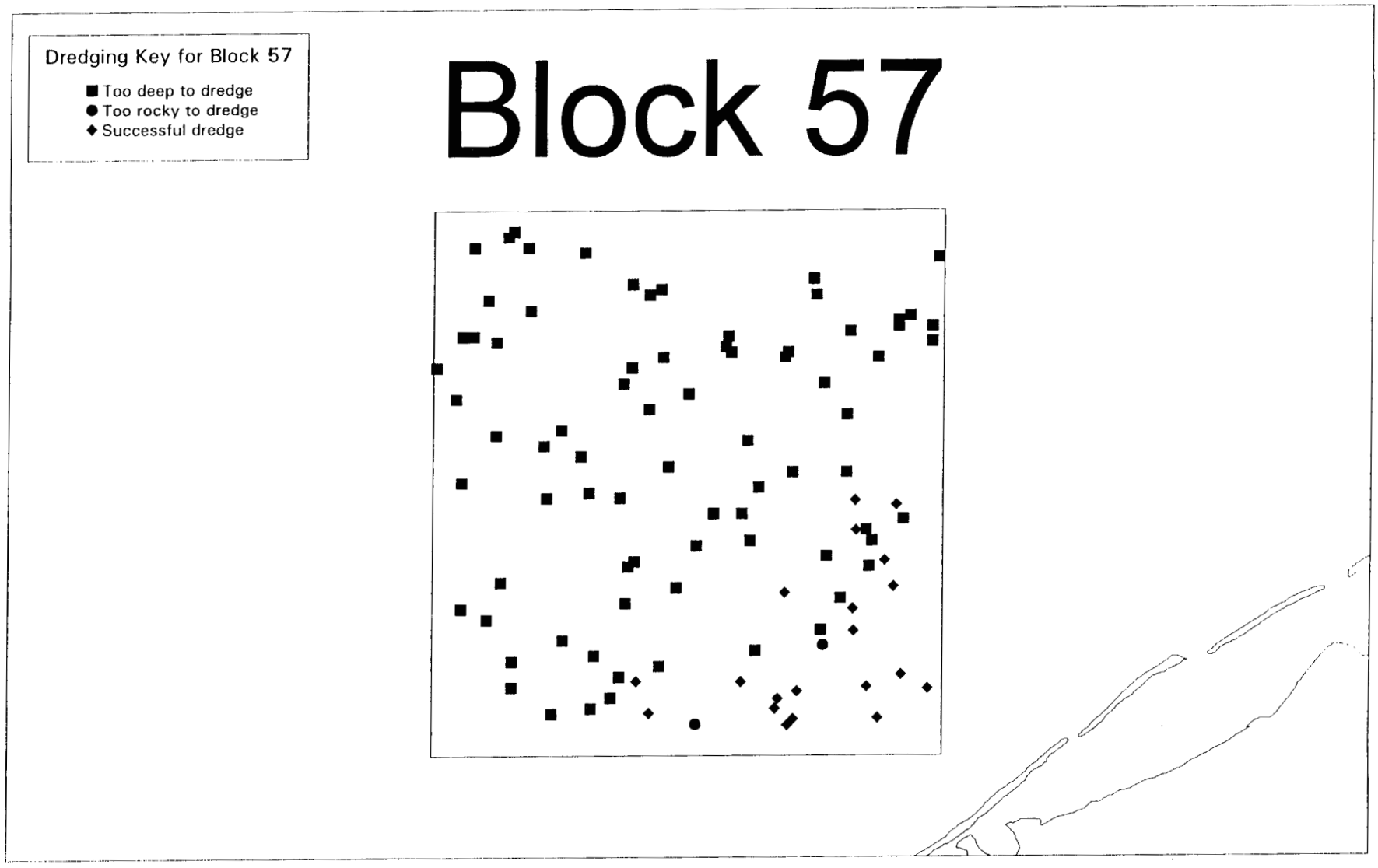


Figure 2. Block 57 first 100 random tow locations, indicating whether tows were performed. In locations where tows were not performed an explanation is provided.

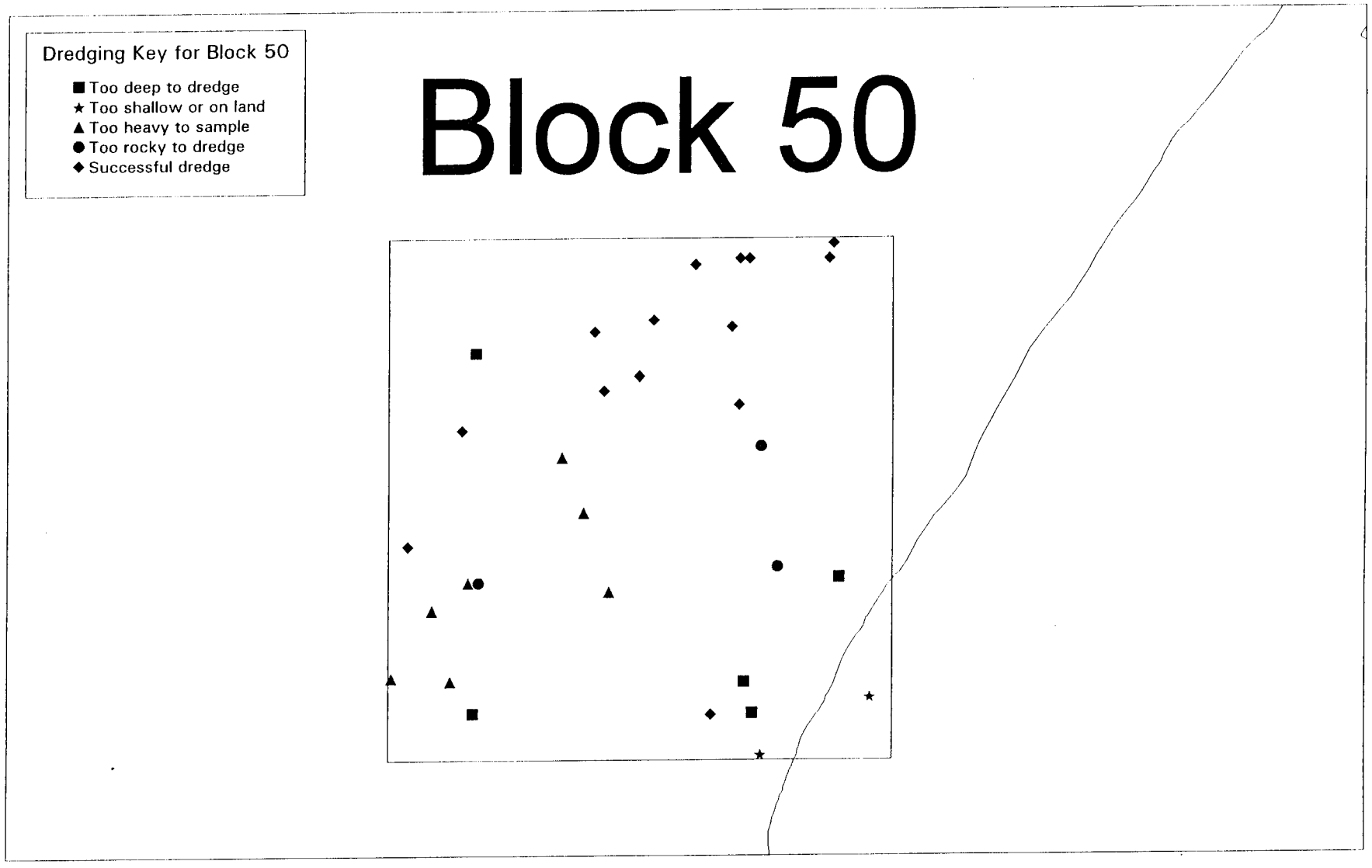
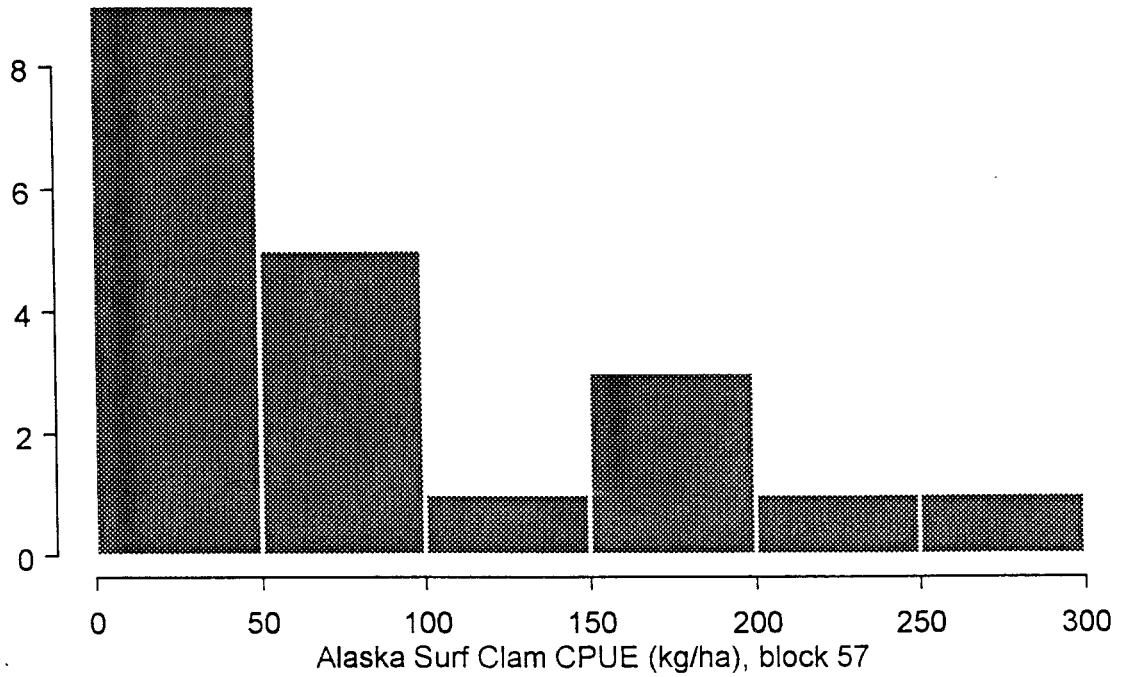


Figure 3. Block 50 first 30 random tow locations, indicating whether tows were performed. In locations where tows or samples were not performed an explanation is provided.



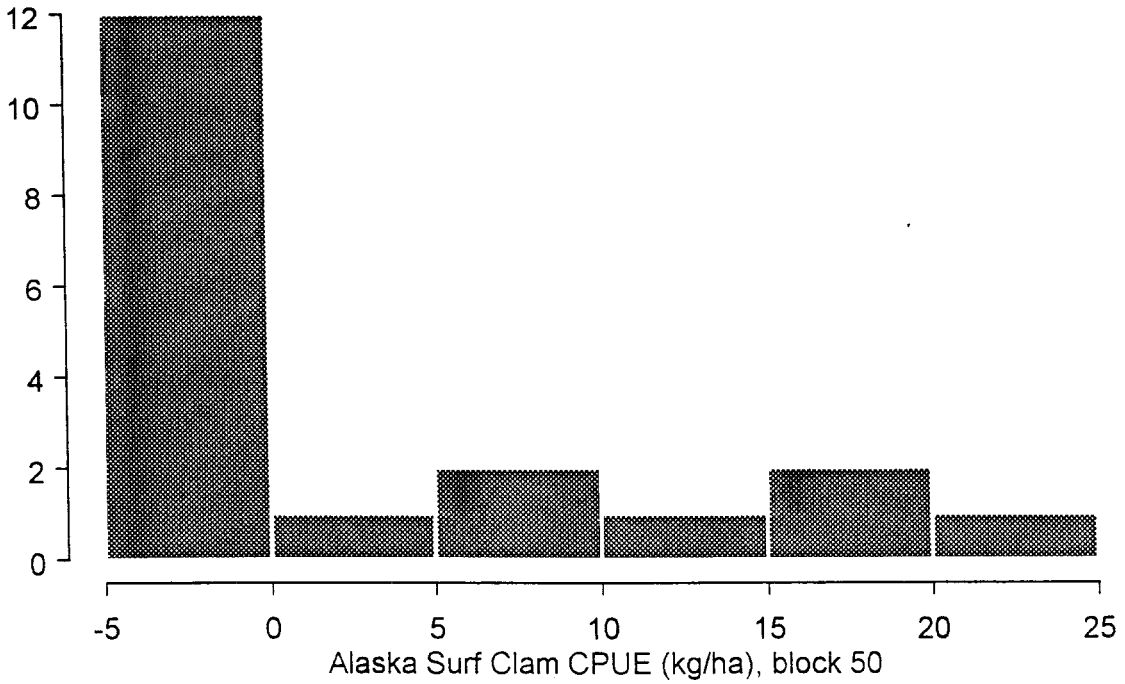


Figure 4. Histogram for Alaska surf clams density in CPUE (kg/ha) from samples in block 57 and 50.

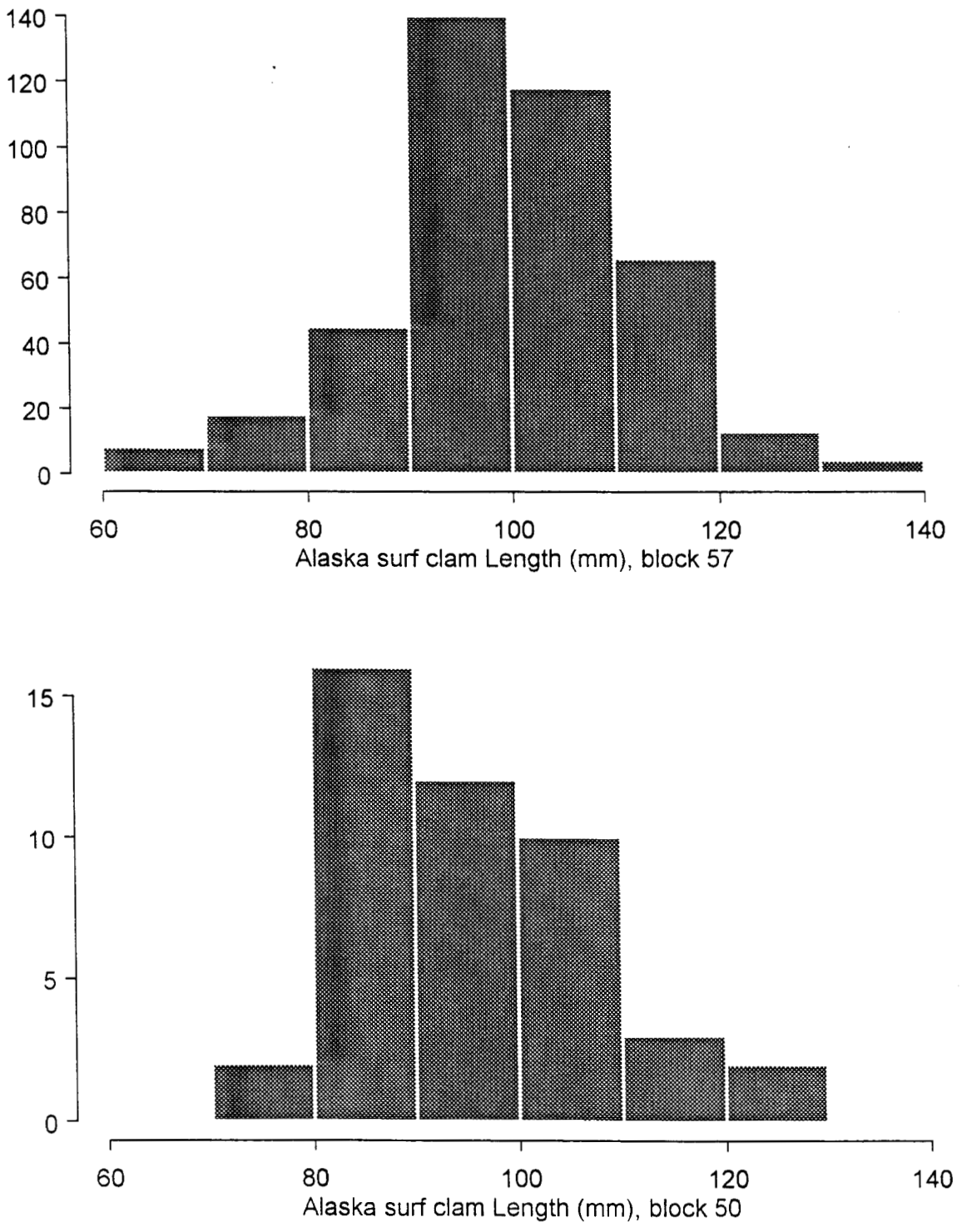


Figure 5. Histogram for Alaska surf clams shell lengths (mm) from samples in block 57 and 50.

Appendix

APPENDIX A.

ALASKAN CLAM CORPORATION

Box 192
Ester, Alaska 99725 USA

Phone: (907) 479-5426
Fax: (907) 479-5425

23 November 1993

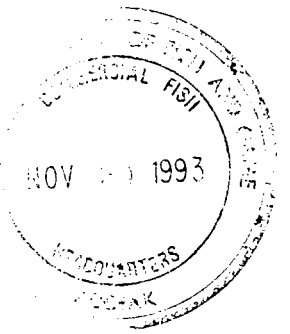
Larry Nicholson
Western Region Supervisor
Alaska Department of Fish and Game
211 Mission Road
Kodiak, Alaska 99615

Hello Larry,

Here is the report on the clam survey that we did in October in Bristol Bay. I want to thank you for your assistance. If you have any questions concerning the report or the survey, give me a call.

Sincerely,

William B. Kopplin
President



SURVEY ON ABUNDANCE OF ARCTIC SURF CLAM

IN THE SOUTHERN BRISTOL BAY

23 NOVEMBER 1993

PREPARED BY ALASKAN CLAM CORPORATION

FOR THE ALASKA DEPARTMENT OF FISH AND GAME
KODIAK, ALASKA

CLAM SURVEY IN SOUTHERN BRISTOL BAY

Alaskan Clam Corporation (ACC) conducted a survey between 20 - 27 October 1993, in order to assess the abundance of the Arctic surf clam (Mactromeris polynyma) in southern Bristol Bay and to determine if there is any by-catch with a modified hydraulic dredge or digger.

A previous survey had been conducted by the Alaska Department of Fish and Game, National Marine Fisheries, Seattle Wa., and private industry in 1977 and 1978. No follow up surveys have been done to the present time. ACC wanted to see if the present biomass of the clams were equal to the biomass calculated in the 1977-1978 study.

Area of operation:

The area of the survey was from Port Moller north to Port Heiden. The boat worked in water depths greater than 4 fth (7.4 m) and less than 17 fth (31.4 m) (Figure 1.)

Equipment used:

The equipment that was used was a 48 in (122 cm) commercial hydraulic clam digger, which employs a knife blade 41 in (104 cm) wide. The digger uses water pressure to fluff the substrate and the collecting bag is then pulled through the loosened sediment. Large clams are retained inside the bag while the smaller ones drop through the harvester and back onto the sea floor. The harvester has openings that are approximately two in (5 cm) apart and the collecting bag has rings two in (5 cm) in diameter to allow escapement. A picture of the harvester is shown in Figure 2.

Method of survey:

ACC chose four blocks from the 1977-1978 study to reoccupy. Samples stations were randomly selected by the Department of Fish and Game's Kodiak office within each block. These positions were plotted on to a nautical chart. If a depth was greater than 17 fth (31.4 m) it was excluded. (The boat has only enough hose to reach down to 17 fth and still maintain the proper depth to hose ratio for towing.) All positions less than 4 fth (7.4 m) at high tide were also excluded. Positions that were close to known rocks were excluded so as not to damage the equipment. Twenty stations per block were required in order to calculate the biomass within statistical guidelines. The station positions are listed in Table I.

A global positioning system (GPS) was used on the boat for positioning and the tows were for 15 minutes in duration. Speed of the vessel was approximately 1.5 knots. Sampling at one station had to be stopped early due to rocky bottom.

The results from the tows were sorted, counted, and weighed. Some clams were kept for paralytic shellfish poisoning samples for the Department of Environmental Conservation and for the University of Alaska, Fairbanks Museum collection. All unused clams and any non commercial catch was recorded and returned to the sea.

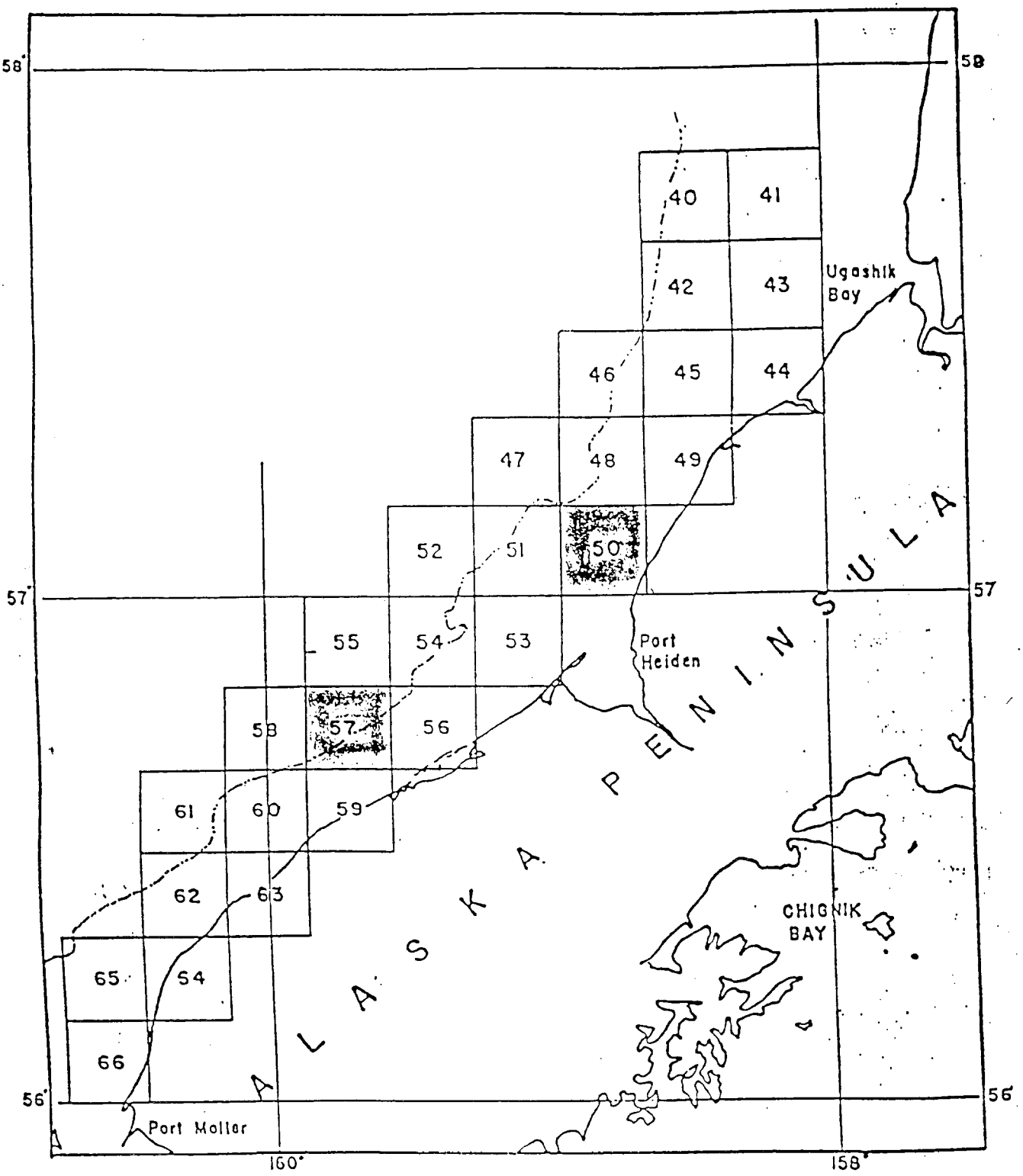


Figure 1. Locations of survey blocks for clam survey in the southern Bristol Bay. Blocks darkened were surveyed by the Alaskan Clam Corporation in 1993.

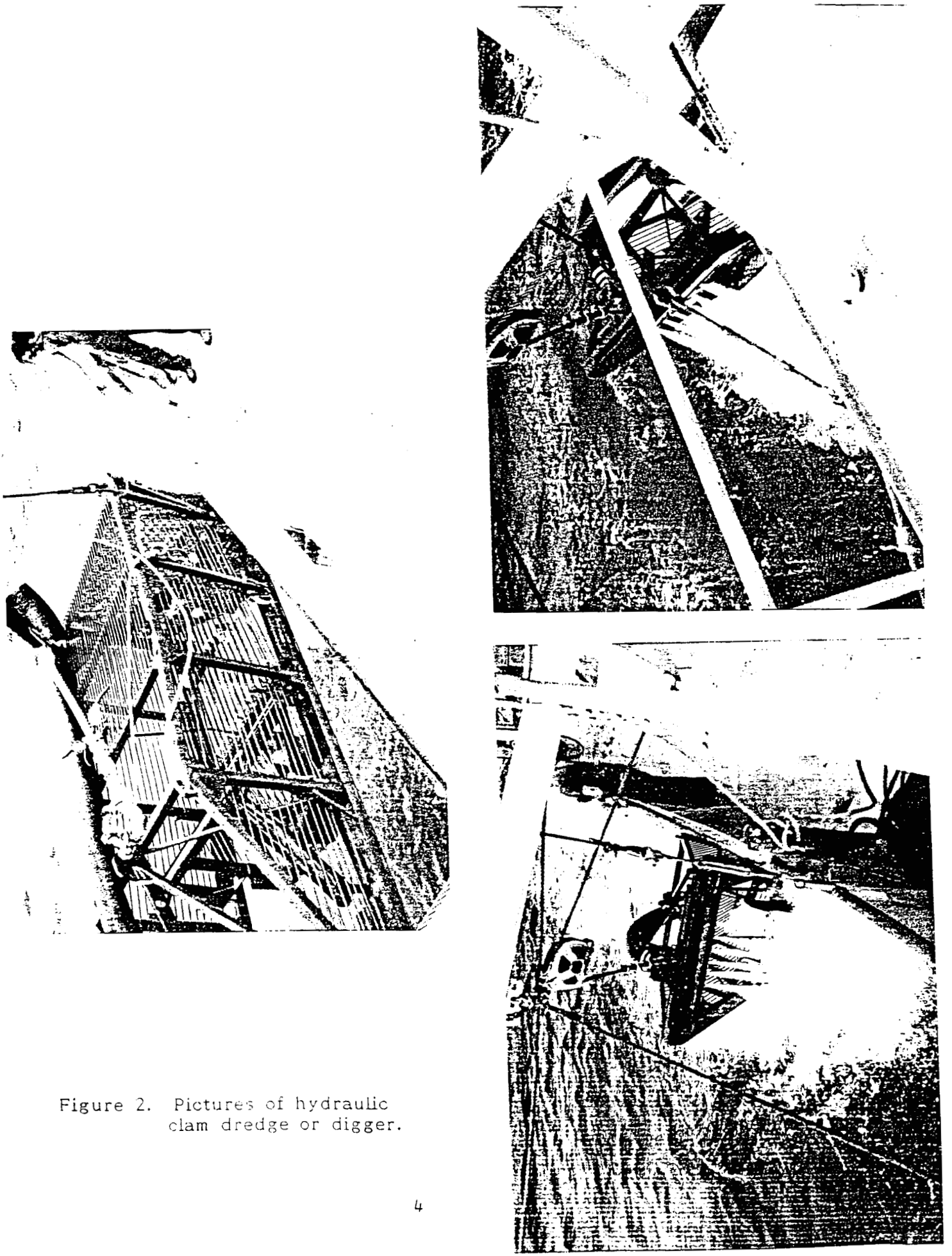


Figure 2. Pictures of hydraulic clam dredge or digger.

TABLE I
RANDOM STATION POSITIONS

BLOCK 57

STATION	LATITUDE DEGREES	LATITUDE MINUTES	LONGITUDE DEGREES	LONGITUDE MINUTES	
101	56	44.4	159	33.1	
102	56	44.7	159	37.5	TOO DEEP
103	56	47.9	159	32.6	TOO DEEP
104	56	47.7	159	34.3	TOO DEEP
105	56	47.0	159	42.0	TOO DEEP
106	56	48.5	159	41.0	TOO DEEP
107	56	42.6	159	34.6	TOO DEEP
108	56	44.2	159	38.1	TOO DEEP
109	56	43.2	159	42.1	TOO DEEP
110	56	40.2	159	36.7	
111	56	44.1	159	32.4	TOO DEEP
112	56	47.2	159	33.3	TOO DEEP
113	56	44.6	159	43.5	TOO DEEP
114	56	45.0	159	36.3	TOO DEEP
115	56	43.7	159	33.5	TOO DEEP
116	56	49.2	159	43.7	TOO DEEP
117	56	48.4	159	41.4	TOO DEEP
118	56	42.0	159	35.3	TOO DEEP
119	56	46.4	159	48.2	TOO DEEP
120	56	44.2	159	39.1	TOO DEEP
121	56	44.5	159	42.4	TOO DEEP
122	56	43.2	159	33.6	TOO DEEP
123	56	47.4	159	38.7	TOO DEEP
124	56	40.7	159	36.0	
125	56	42.5	159	42.2	TOO DEEP
126	56	44.5	159	45.0	TOO DEEP
127	56	48.0	159	32.2	TOO DEEP
128	56	42.4	159	48.0	TOO DEEP
129	56	45.5	159	45.1	TOO DEEP
130	56	45.3	159	43.8	TOO DEEP
131	56	41.3	159	41.0	TOO DEEP
132	56	48.3	159	47.1	TOO DEEP
133	56	44.6	159	34.5	
134	56	40.2	159	39.7	TOO ROUGH
135	56	43.9	159	33.8	
136	56	41.0	159	41.1	
137	56	47.6	159	38.6	TOO DEEP
138	56	41.7	159	35.2	ROCKY
139	56	41.0	159	37.6	
140	56	40.3	159	36.0	
141	56	49.3	159	47.6	TOO DEEP
142	56	47.2	159	36.6	TOO DEEP
143	56	44.8	159	48.0	TOO DEEP
144	56	43.7	159	37.8	TOO DEEP
145	56	40.2	159	31.8	
146	56	45.6	159	37.9	TOO DEEP
147	56	45.1	159	40.7	TOO DEEP

148	56	47.6
149	56	46.5
150	56	47.0
151	56	47.8
152	56	40.9
153	56	42.2
154	56	41.0
155	56	46.7
156	56	40.7
157	56	48.7
158	56	41.5
159	56	41.1
160	56	43.4
161	56	40.5
162	56	48.4
163	56	47.5
164	56	47.3
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184	56	47.6
185	56	49.5
186	56	42.8
187	56	48.6
188	56	48.1
189	56	40.4
190	56	46.2
191	56	40.5
192	56	41.8
193	56	43.6
194	56	45.8
195	56	43.4
196	56	47.5
197	56	45.0
198	56	42.9
199	56	40.8
100	56	42.7

159	48.0	TOO DEEP
159	40.0	TOO DEEP
159	48.9	TOO DEEP
159	31.4	TOO DEEP
159	32.2	
159	47.1	TOO DEEP
159	33.1	
159	35.2	TOO DEEP
159	42.7	TOO DEEP
159	35.6	TOO DEEP
159	43.3	TOO DEEP
159	33.1	
159	35.1	TOO DEEP
159	43.4	TOO DEEP
159	35.5	TOO DEEP
159	31.4	TOO DEEP
159	36.5	TOO DEEP
159	34.5	
159	46.2	TOO DEEP
159	44.8	TOO DEEP
159	45.7	TOO DEEP
159	37.6	TOO DEEP
159	42.3	TOO DEEP
159	40.9	TOO DEEP
159	31.2	TOO DEEP
159	46.2	TOO DEEP
159	46.8	TOO DEEP
159	38.5	TOO DEEP
159	41.9	TOO DEEP
159	34.5	
159	33.7	TOO DEEP
159	42.4	TOO DEEP
159	32.6	TOO DEEP
159	33.6	
159	46.2	TOO DEEP
159	34.4	TOO DEEP
159	47.6	TOO DEEP
159	46.4	TOO DEEP
159	40.4	TOO DEEP
159	42.0	TOO DEEP
159	45.6	TOO DEEP
159	40.8	
159	41.4	TOO DEEP
159	36.5	
159	44.4	TOO DEEP
159	39.7	TOO DEEP
159	44.5	TOO DEEP
159	32.8	
159	46.8	TOO DEEP
159	34.4	TOO DEEP
159	46.6	TOO DEEP
159	35.5	
159	32.9	

BLOCK 50

STATION	LATITUDE DEGREES	LATITUDE MINUTES	LONGITUDE DEGREES	LONGITUDE MINUTES	
201	57	07.8	158	51.9	TOO DEEP
202	57	07.0	158	42.2	
203	57	00.1	158	41.7	LAND
204	57	00.9	158	52.0	TOO DEEP
205	57	00.6	158	43.7	
206	57	00.9	158	42.0	TOO DEEP
207	57	03.4	158	51.8	ROCKY
208	57	09.9	158	39.2	
209	57	01.5	158	42.3	TOO DEEP
210	57	08.7	158	45.5	
211	57	01.5	158	54.5	
212	57	03.5	158	38.9	TOO DEEP
213	57	09.9	158	42.7	
214	57	08.3	158	47.3	
215	57	03.8	158	52.3	
216	57	07.2	158	47.0	
217	57	09.5	158	43.3	
218	57	09.8	158	39.8	
219	57	04.7	158	53.9	
220	57	03.1	158	52.9	
221	57	04.3	158	48.7	
222	57	08.2	158	42.5	
223	57	05.4	158	49.0	
224	57	09.4	158	42.8	
225	57	03.7	158	41.1	ROCKY
226	57	01.5	158	53.3	
227	57	06.0	158	41.7	ROCKY
228	57	03.0	158	48.1	
229	57	01.2	158	37.8	LAND
230	57	07.5	158	46.7	

The raw data from each tow was given to the Alaska Department of Fish and Game in Kodiak so a biomass determination can be calculated.

Results:

Forty four stations were occupied during the survey. Bad weather prevented us from occupying more stations. We worked in block 57 north of Port Moller and block 50 north of Port Heiden. The abundance of the Arctic surf clam was much lower than anticipated and what had been reported in the 1977-1978 report. There were more clams in block 57 than in block 50. We found fewer of the clam Tellina and no cockles that were reported in the earlier study. Using the random station grid, we could not pick the areas where we thought the clams would be and we tended to pick up a large amount of rock. This rock caused a high percentage of breakage to the clams in the bag. Sea stars were in abundance where there were clams. These were also counted and weighed. The results from the tows can be seen in Table II.

The by-catch from the dredge was extremely small. The dredge caught no crab and only four flatfish during the entire survey. The escapement of juvenile clams from the dredge worked very well: very few small surf clams were caught.

Block 57- 40 miles north of Port Moller

The 21 stations that were occupied in this block showed clams in all stations. Only seven stations showed weights greater than 20 lbs. with the largest weight being 48 lbs. Station 801 was done as a comparison to the 1978 survey in an area with a large concentration of clams. Only 16 lbs. of surf clams were found. In the 1978 survey 423 lbs. of surf clams were caught.

As expected, the number of sea stars increased with an increase in the number of clams. Ten stations had a large amount of rock in the samples. This caused a significant increase in breakage of the clams.

Block 50- 10 miles north of Port Heiden

The 21 stations sampled in this block showed fewer over all clams than in Block 57. We only collected clams at 8 stations and the weight was less than 10 lbs. at each station. Thirteen stations showed no clams at all. Station 902 was also done as a comparison to the 1978 survey. We caught approximately 3 lbs. In 1978 450 lbs. of clams were caught.

This area had a lot more rock than Block 57. There were 13 stations that showed a large amount of rock. Two stations showed a large number of sand dollars.

Stations 01 & 02- outside Port Moller

These two stations were added to test the gear. Station 01 showed no clams. Station 02 showed few clams and some rocks.

TABLE II

STATION, POSITION, AND AMOUNT OF SURF CLAMS FOUND

STATION #	LATITUDE	LONGITUDE	SURF CLAM WT. IN LBS.
BLOCK 57			
133	56 44.45	159 34.44	9
101	56 44.37	159 33.18	29
135	56 43.89	159 33.79	31
136	56 41.01	159 41.09	0.5
139	56 41.0	159 37.66	4
801	56 42.7	159 36.88	16
165	56 41.98	159 34.55	13
159	56 41.14	159 33.14	16
152	56 40.87	159 32.11	23
154	56 40.91	159 33.21	22
124	56 40.68	159 35.98	38
110	56 40.18	159 36.75	13
145	56 31.97	159 31.98	48
140	56 40.30	159 35.39	6
181	56 40.32	159 33.50	23
191	56 40.50	159 36.22	14
189	56 40.41	159 40.60	7
199	56 40.82	159 35.47	4.25
177	56 42.20	159 34.34	1.25
195	56 43.32	159 32.91	1
100	56 42.82	159 32.85	2
BLOCK 50			
219	57 04.15	158 54.48	4.5
215	57 03.75	158 52.90	0
220	57 03.14	158 52.79	0
211	57 01.83	158 54.52	0
226	57 01.41	158 53.58	0
228	57 02.89	158 48.23	0
221	57 04.60	158 48.55	0
223	57 05.44	158 48.65	0
902	57 05.99	158 51.91	3
216	57 07.31	158 46.92	0
230	57 07.42	158 46.75	0
214	57 08.49	158 47.30	1
210	57 08.68	158 45.93	3
224	57 09.29	158 43.14	0
217	57 09.52	158 43.16	3
213	57 09.78	158 42.90	2
218	57 09.73	158 40.00	4
208	57 09.87	158 39.13	0
222	57 08.54	158 42.06	0
202	57 07.24	158 42.36	3
205	57 00.44	158 43.83	0

Conclusions:

The hydraulic digger works satisfactorily in harvesting the clams. Escapement of small clams, less than 8.5 cm (3.3 in) in length works well. Only mature size clams were caught. Additionally, the by-catch of non-targeted species was almost non-existent. The amount of by-catch for the 44 stations was zero crab and four flatfish, two yellow fin sole and two rock sole. No fin fish were caught. This shows that the modifications made to the dredge were sufficient to kept non-targeted species out of the harvester. The survey was conducted in a known crab area and did not catch any crab.

The lack of clams is a great surprise to us. We expected to find the same numbers of clams as in the original survey. We realize that the clams live in patchy areas, but using this type of sampling scheme does not allow for sampling those areas. The clams in block 57 seemed to be uniform but in much lower densities than were previously recorded. Block 50 had a lot more large rock and very few clams. There may be commercial volumes of clams in these areas, but it will take concerted effort to find them. The personnel at the Kodiak Department of Fish and Game are working on the biomass calculations.

Due to financial restraints and the weather, we were unable to work on any other of the intended blocks. We feel that the results show a good representation of the area.